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Professor John Henry Neville

ARTICLE I

John Henry Neville was born in the South-eastern corner of Christian County, Kentucky, fourteen miles south of Jefferson Davis' birthplace, November 16, 1827. From 1846 to 1849 he was a student in Bethany College, Virginia, graduating from this institution with the degree of Bachelor of Arts. In 1852 the same historic institution conferred on him the degree of Master of Arts. During the years 1852 to 1857 he was connected with Eureka College, Illinois, which institution he had helped to found, and in 1857 to 1858 he was Professor of Greek and Latin in Christian University, Canton, Missouri. From 1859 to 1865 he was connected with Kentucky University, then located at Harrodsburg. At the close of the Civil War, Kentucky University was moved to Lexington, reorganized and incorporated with Transylvania. Professor Neville was appointed to the Chair of Greek and Latin in the new institution and held this professorship till 1880. In 1880 he became professor of Greek and Latin in the State College of Kentucky, which position he still holds. In 1899 the State College of Kentucky conferred on him the degree of Doctor of Laws.

These are only the bare landmarks of a life of usefulness and honor, the greater part of which has been spent in our community. In after years they will serve to locate him in the tangle of human events. No biography, however, let alone the bare enumeration of dates, such as the above, can ever reproduce the real man. The one will always remain a narrative, the other is a vital force. For a period of fifty-five years Professor Neville has held a college professorship, and during all this long period of honorable service, a lifetime in itself, with the exception of five months abroad, and three weeks of sickness, he has never missed a single day from the class-room.

The writer of this sketch regards it as a happy coincidence that he entered the State College of Kentucky as a student at the time that Professor Neville became Professor of Greek and Latin in this institution, and among all the men that he has known in Lexington since boyhood, this man will always remain in his memory of olden scenes and days as one of the most interesting personalities, one of the strongest characters, one of his best friends, and one of the brightest and most charming of his elder companions. During all of this time Professor Neville has lived the quiet life of the scholar and, except, perhaps, for his deep interest in all that went on about him, one might say the life of the recluse. He is one of the few men whom I have known who have had the happy faculty of attending only to their own business. In all the time that I have known him he has never made a speech, nor addressed an open-air meeting of citizens on the duties of citizenship or, indeed, upon any of the burning subjects of the hour. In the course of his reading he has been brought into intimate association with the great minds of all the ages. He has walked and talked with Caesar and he has listened to Demosthenes at Athens and beside the sea. It is not to be marveled at, therefore, that he is sometimes impatient at little things and that at times he is inclined to be a trifle cynical. To him the average man must, of necessity, have proved somewhat tiresome, and to him a faculty-meeting is a pow-wow and a babel of loose tongues, and to a man of his learning and culture the average college exercise can only afford the slightest amusement if even that. That he did not speak, however, was not for the reason that he had nothing to say. Far from it. He knew too much. He used to say to me in that kindly, ironical way of his, his eyes twinkling and his thin lips twitching, "Joe, my boy, I really would like to make just one speech around here, but you know if I did, I should have to leave the college grounds on horse-back and Lexington by the next train."

His work as a teacher has been singularly free from the fads and vagaries of the so-called modern educational methods. To him there is but one road to learning, both for student and instructor, and that the road of hard work and unceasing application. He has tried as best he could, and often it must indeed have been a sore trial, to teach a certain amount of Greek and Latin to that interesting species, boy Americanus, variety Kentuckiensis, and it has not given him any great concern, or kept him awake at night, whether the divine spark reached the youth by way of the optic or auditory

nerves, or whether through the solar plexus or the delicate nerve endings of the spinal cord, provided that ultimately it found a permanent lodgment in his brain. He has his own peculiar short cuts and rugged ways of teaching, and while he never began his classes with a hymn or a prayer or a kindergarten rhapsody, or closed them with the doxology or a health exercise or a heart to heart talk with students, every man who ever attended his classes realized that here was a man who had done his best to kindle within him (the student) that spark of enthusiasm that is required for all great achievements, whether in the Arts or Sciences, in business, or in the learned professions; and he knew further that this man had relieved the tedium of many a class hour, with observations and anecdotes that in real humor, incisiveness and point were worthy of Thackeray or Voltaire or Mark Twain, and with many an historical and philosophic allusion that it would be well to remember and take to heart.

During his long life he has witnessed many changes. It is interesting to record that he has stood aloof from them all. He has been living out his own life, not a life of imitation, but a life to imitate—honorably, actively, and like a gentleman to its close. But, as I was saying, he has seen many changes. In his own profession he has witnessed the arrival on the scene of the so-called educator. for these interesting personages the title of college professor is much too tame. A few years ago they came upon us, we know not whence, sounding upon the cymbals and the tinkling brass, blatantly advocating phonetic spelling and the simple life. These are they who would do things—and you too perhaps—if they had the opportunity. They conduct institutes, spelled, so says Professor Neville, *institoots*. For them no element of culture is sacred. They illustrate gospel texts with funny stories and with the slang of the street. In one breath they talk to us learnedly of the delicate sensibilities of the child mind, until they make some of us old-fashioned teachers feel like cannibals, and in the next, just to show their versatility, they lead the audience in singing a sacred hymn to the tune of a popular air. In a way these so-called educators are really very refreshing, but after we have heard one or two of them we begin to feel glad that there are a few of the old teachers left in the world and for solace and comfort we creep home to Professor Neville and take a chair in his study and simply

sit there and rest and dream in the peaceful quiet atmosphere of the home of the scholar and the man of understanding.

We are glad to think that he belongs to the old order of things, and that these later days have brought no bustle or confusion into his well ordered life. To those of us who feel a pride in the old traditions of our town and state, he remains one of the few living ties to bind us to the old days of Transylvania, when scholars came from across the sea and students from across the mountains and up the Mississippi from New Orleans to the great University at Lexington in quest of learning.

Every man and woman in Lexington, and far beyond its confines, knows that Professor Neville has left the impress of a great personality upon hundreds, perhaps even thousands, of young men and women throughout our state and country and that in his hands they have been as clay in the hands of the potter.

A man lives again in his children, a great teacher in the minds of his students.

J. H. K.

The Purchase of Coal Under A Specification

By Philip M. Riefkin, '06

ARTICLE II

ACCORDING to the report of the U. S. Geological Survey of Mineral Resources for 1905, the total production of coal in 1906 was estimated to be over 425,000,000 short tons, representing a value exceeding $500,000,000.

The United States has since 1899 been placed at the head of all the coal-producing countries of the world, the out-put in 1906 being about 38 per cent of the world's production.

The demand of the home market fully takes care of all the coal mined in the United States so that if we make a conservative estimate, that the cost of transporting the coal to the consumer is equal to its real value, the annual expenditures for coal in the United States aggregate more than $1,000,000,000.

A careful consideration of the terms of sale is justified, both from the financial importance of coal purchases and the effect of the use of this fuel upon the industrial development of the United States.

The vast annual expenditures for the product, whether by the railroads, manufacturers or householders is for one ultimate purpose, the production of heat.

With heat production the prime object, should not the heat producing power of the coal be recognized in the terms of its sale?

Coal may be roughly classified in four groups, namely, brown coal or lignite,bituminous coal, semi-bituminous and anthracite. This classification has for its basis the relative proportions of carbon and volatile matter contained in the combustible portion of the coal. A coal containing 7.5 per cent of volatile matter in the combustible, would be classified as anthracite; between 7.5 and 25 per cent as semi-bituminous or semi-anthracite; between 25 and 50 per cent as

bituminous, and over 50 per cent as lignite. In addition to carbon and volatile matter all coals contain varying quantities of moisture and ash.

The economic value of a fuel is affected by the actual amount of combustible matter it contains, as determined by its heating value, shown in British Thermal Units per pound of fuel and also other factors, among which is its ash content.

The measure of heat or The British Thermal Unit, is the quantity of heat required to raise the temperature of one pound of pure water one degree Fahrenheit at or near its temperature of greatest density, 39.1 F°

The ash not only lowers the heating value and decreases the furnace capacity, but also materially increases the cost of handling the coal, the labor of firing and the cost of removal of the ashes.

The moisture content of the coal is another important factor to be considered. Moisture lowers the effectual heating value of the coal, since heat must be given up to drive off the moisture, before the heat is actually realized.

The heating value of different coal measured in B. T. U. per pound depends largely upon the district in which the coal is mined, that is, upon the geographical location. It is greatly influenced by the method and care in mining and by the percentage of ash, which varies in the different mines and coal beds in the same district.

The consumer is principally concerned with the heat-producing value of the coal as delivered with whatever ash and moisture it may contain.

It is within the province of the engineer to devise the plan and execute the mechanical arrangements to utilize that coal or class of coals among those commercially available at a given point which will produce the greatest return for the net cost. When the kind of coal has been decided upon, it is the duty of the purchasing agent to contract for the fuel under terms which will be fair, both to the dealer and to the user.

The most familiar plan is to buy coal on the reputation of the district in which it is mined. This might safe-guard the purchaser if all the coal was alike in the same district or group of mines, but coals of the same class not only vary widely in different localities but in the same mine.

Another plan is to purchase coal on the basis of a standard and guaranteed analysis and to permit rejection if the variation from the standard exceeds certain established limits.

The success of this plan depends to a considerable degree upon actually securing coal within the limits set for rejection, for in an important contract or in the case of inadequate storage facilities requiring constant deliveries, the rejection of the coal might subject the purchaser to the greatest loss due to delay in replacing the delivery, while a forced acceptance of the inferior coal without adjustment of price, would in effect nullify the force of the contract.

Furthermore, in the latter case no comparative basis of adjustment would be provided in the cases of a necessary substitution of another coal for the one specified.

This position was realized by Mr. Henry J. Williams, coal expert, in an address before the New England Railroad Club in 1896, who said in part:

"There is a growing appreciation among engineers and manufacturers of the importance of knowing accurately what they are doing. In the purchase of coal, for instance, where it is impossible to judge the quality of the article by its appearance, or by its price, determinations of the exact calorific power should prove of the greatest economical value. The day is not far distant when the prices paid for coal will be set by the number of heat units which are obtainable therefrom, as this is the only safe and rational system to follow in the purchase of large quantities of coal.

Furthermore, in the latter case no comparative basis of adjustany coal does not indicate how it will behave when fired, the calorimeter test and the analysis of the coal combined, when properly interpreted, not only disclose the true heating power and commercial value, but also indicates fully the manner in which it will behave on the grate."

This recommendation is nothing but a practical application of the results of accurate knowledge to questions of commercial importance, for experience has abundantly shown that a careful knowledge of facts, so obtained, has never yet failed to bring about economics which could not be secured in any other way.

The following is an editorial from the *"Electrical World"* of April, 1907:

COAL SPECIFICATIONS.

"As will be noted elsewhere, specifications have been prepared by United States Government engineers in the purchase of coal, which specifications have been adopted by several of the National Government Departments as part of their fuel proposal form. This is an indication of a movement which, though slow in advance this far, promises in time to establish a practice under which large users of steam power will specify the thermal and other economic values of fuel, and by test on samples determine if the requirements are satisfied, in the same manner that manufacturers specify and test materials purchased that enter into their output. It is certainly inconsistent to purchase a steam engine on guarantees fixing the consumption of steam within the limits of a tenth of a pound and then give little or no attention to the qualiy of fuel, variations in which may affect the evaporation more than a pound of steam per pound of coal. Since the value of fuel even from the same mine may vary considerably at different workings and at different cross sections of vein, a hard and fast fuel as to thermal value and percentage of ash would almost inevitably become a source of trouble. The government specifications therefore appear to be eminently wise in declaring a standard and then allowing a premium where this standard is exceeded and exacting a forfeit where it is not attained. The object of the specifications moreover, is not to establish an absolute standard of fuel, which would limit the sources of supply for government use, but to fix a fair one for a given fuel, and then, even though the standard be low, give the seller the benefit of any excess, and in case of deficiency, place the penalty where it belongs. As the government is a large user of coal, the effect of these specifications will probably in time be to fix exactly the relative money value of different grades of coal which at present is only roughly recognized. In view of the fairness of the principles on which the specifications are established opposition to them by any mine owners will be apt to awaken a suspicion that they do not want their product to be subject to a plan which would fix its relative market value. As users of coal, central stations will be largely benefitted by the ratings of fuel which the government specifications will thus establish, and the larger plants might well consider the advisability of adopting the specifications for their own use in purchasing fuel."

The form of speculations now used by the Government was

carefully reviewed by prominent coal dealers, engineers and private corporations interested in the subject, who as a rule adjudged it to be fair and just to both parties. The specification is drawn up, so as to enable the users to describe the kind of coal desired, which may be anthracite or bituminous, and in the latter case with such proportion of volatile matter as will include either eastern or western varieties as may be demanded.

Under this plan, also, bids may be secured for a number of classes of fuel, procurable in a given market, and then compared with the view of selecting the one showing the highest economic value.

What is actually desired is not necessarily the cheapest or the highest grade of coal, but the coal which will insure the greatest net economy in plant operation.

The heating value, expressed in B. T. U. of coal containing approximately the same percentage of ash, is essentially a direct measure of the actual value to the purchaser, and for this reason the specifications provide for an adjustment of payment in direct proportion to the variation in heat units in the coal as received. As the coal is weighed when delivered and the payments are based also upon the price per ton, it is necessary to determine the heating value of coal in condition in which it is received containing whatever moisture may be present at the time.

A further correction in payment will be made for variation of ash in dry coal in order to take account of the cost of handling addition fuel and ash, and its effect on the capacity of the boiler and furnace.

The application of this system will not only enable the award of a contract to be made in an equitable manner, but will also remove many of the usual causes of dispute as to the character and quality of the coal subsequently delivered and provide a satisfactory basis for the correction of payments for differences in quality in favor of the party in whose interest it is due.

It is believed that the enforcement of the provisions of the specifications will operate equitably both with respect to the Government and to the contractor, inasmuch as a premium is provided as well as a penalty and will guarantee adequate protection to each party.

Philip M. Riefkin.

A Discussion of Some Phases of Electric Signaling for Steam Railroads

By A. M. Wilson
Professor of Electrical Engineering

ARTICLE III

THE first signaling devices were, of necessity, crude. One of them, for instance, consisted of a disk and lamp rotating through ninety degrees about a vertical axis. The disk was painted red, and, for danger was turned so that it could be seen by the engineer. The lamp showed red for danger, and white for safety. This was used about 1835 in Britain. The semaphore was developed later, and it has become more and more common, because it can be seen farther than a round or square surface of the same area. It has been shown that, under average conditions of atmosphere, and on cloudy days, a body six feet long and one foot wide, above the horizon, can be seen by the naked eye at about six miles.

Electricity has beeen applied to signaling on railroads at intervals since 1844. The first recorded attempt to establish electric signals was made in Britain at that time.

Until quite recently, especially in America, signaling has been considered primarily a form of insurance, and, as the electrical equipments were rather expensive, they were not used very extensively. Since it has beeen conclusively demonstrated that a complete system of reliable signals is of great assistance in operating trains, the expense of an electric signal equipment has not been considered so unfavorably. Besides, like other developments, the application of electric signals has furnished opportunities for improvement in design, so that the cost is decreasing, and the reliability of operation is increasing.

The electric signaling systems in operation are the result of attempts to develop automatic signaling. In the elimination of possible mistakes due to carelessness of individuals, dependence has been

placed upon a combination of electrical and mechanical devices, the operation of which is started by the passing train. While the operation of the electric signals may be considered automatic, yet if the batteries, motors and mechanism transmitting motion to the semaphore are not given careful and intelligent attention, no system involving these elements will be operative. For instance, in one of the arrangements described in this article, there are six contacts in series, in a relay circuit. Evidently these contacts should be given careful inspection occasionally. The primary batteries largely used heretofore seem to be the weakest link in the chain, so far as care and attendance is concerned; and attempts to eliminate signal failures due to this cause have resulted in the use of the storage battery for operating signal mechanism, and, later, in the development of alternating current apparatus replacing track, line, and signal batteries.

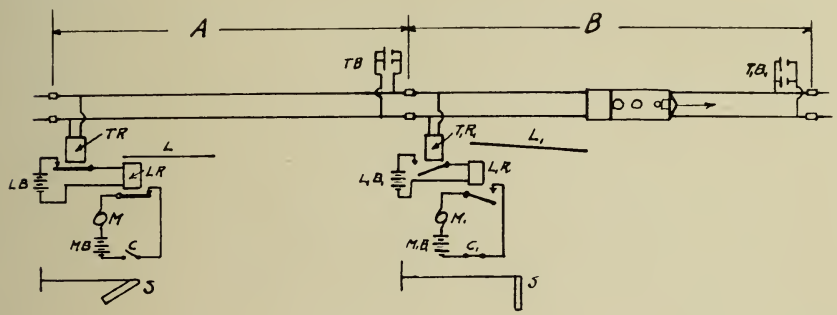


FIG. 1

A rough, preliminary conception of the operation of a signal system may be obtained from Fig. 1. Let us assume one semaphore to each block, movement of trains in one direction, and no distant signals. A train is on block B, which is separated from block A by track insulators. The track battery, T_1 B_1, is short circuited, thus breaking the contact at the track relay, T_1 R_1, which, in turn, breaks the contact at the clutch relay, L_1 R_1. The lever, L_1, engages with a catch which holds the semaphore, S_1, in the clear position after the motor, M_1, has moved it to that position. When the contact is broken at L_1 R_1, the clutch lever, L_1, disengages and allows the semaphore to come to danger. The

line battery, L_1 B_1, is not necessary in the diagram as shown. It is shown because it is used in practical applications of this system.

When the train passes out of block B, the track battery circuit will operate the relay. Then the motor circuit will be closed, and the motor will operate to bring the semaphore to the clear position. Just as the semaphore reaches this position, the motor circuit is broken at C_1 by the mechanism, and the clutch lever holds it in this position. In one instance it took something less than 200 joules to clear the signal, and, with a clutch coil having 2,000 ohms, the energy necessary to hold the signal clear was practically negligible.

Consider now a more complicated system involving trains moving both ways on a single track. Figure 2 represents an arrangement used in practical signaling. The block lengths are the distances between signal A, B, C, etc. Each block length is divided into four track circuits, as shown, for the purpose of giving what is called overlap. A_1, B_1 and C_1, control movement to the left, and A_2, B_2, C_2, control movement to the right. A train on 3 will open relay contacts at S, and therefore throw signals A_2 and B_1 to danger, thus keeping another train moving to the right from entering 1, and another moving to the left from entering 5. If the train on 3 is moving to the right, as soon as it enters 4, it will break three relay contacts at T. The signals A_2 and B_1 will remain at danger, and the signal C_1 will also go to danger, and prevent any train in block D from entering C.

(Continued on page 16.)

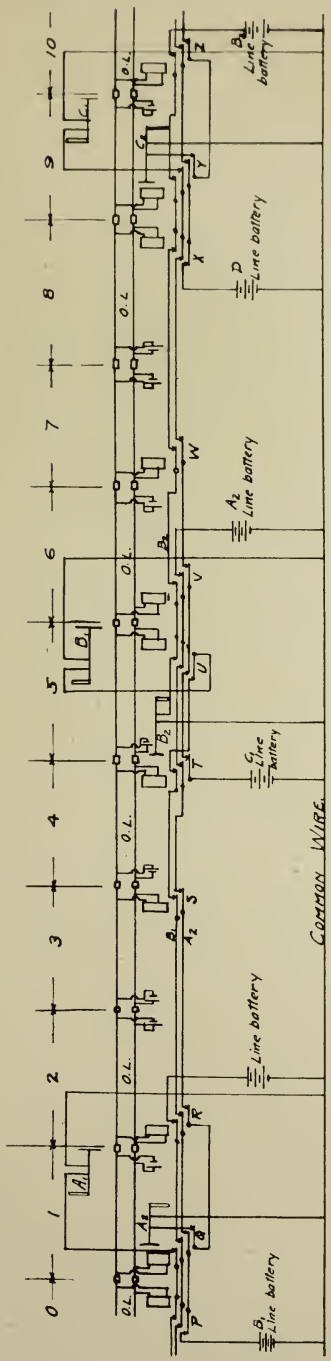


FIG. 2.

Thus a train is made to set the signal at the other end of a block. This prevents two trains from entering the same block from opposite ends at the same time.

It is evident that the number and arrangement of signals which may be operated depend entirely upon the number and arrangement of track relay contacts. It will be noted that there are six contacts in series in each line battery circuit, and that any added signal movements would add to the number of relay contacts. It will also be noted that this system requires three wires on poles, running the entire length of the track, and at intervals four or five wires for short distances; and it is evident that more elaborate signal connections would require more wire.

Perhaps it is well to call attention to the fact that the line batteries simply control the line relays, and sometimes the clutch coils, and that the motor batteries are usually entirely separate.

To avoid the use of so much copper wire and line batteries, the signal system involving polarized relays has been developed. Figure 3 shows a practical layout for this system. A polarized track relay contains two armatures, one neutral and the other polarized. As is well known, the neutral armature—M, in figure 3—will be attracted if sufficient current flows through the magnet coils, no matter in which direction the current flows; and the polarized armature—N, in figure 3—will make contact when current flows in one direction, and break it when current flows in the opposite direction. It may be noted that the battery operating the motor and the clutch coil relays is directly in series with the neutral armature, and that only the distant signal depends upon the polarized armature contact. When the neutral armature breaks contact, both signals go to danger; while, when the neutral armature is closed, the home signal clears, and the direction of current in the track relay coils will determine whether the distant signal will clear or not. These signals are held in the clear position, after having been moved there by the motor, by clutch levers, just as in the system already described. It should be noted that the systems discussed are 'normal clear' systems. There are 'normal danger' systems, in which the clutch coils hold the signals at danger when the block is unoccupied. Up to the present, the majority of signals are installed on the 'normal clear' plan.

In figure 3, consider motion to the left.

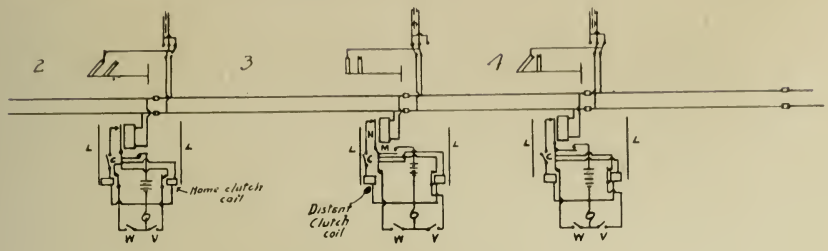


Fig. 3.

When the train is in block 3, the neutral relay contact will be broken, and both the home and distant signals on block 4 will be at danger. Whenever the home signal on block 3 goes to danger, the distant signal on block 4 will be in the horizontal position; because the movement of the home signal of block 3 going to danger reverses the polarity of the track relay in block 4. When the home signal for block 3 goes to danger it opens the circuit breaker, C, so that there will be no tendency for the distant signal to clear until after the home signal clears. It also closes the circuit breaker, V, in the motor circuit. When the home signal clears it closes C and opens V. The distant signal closes the circuit at W on going to danger, and opens it on clearing. The opening of V and W allows the clutch levers, L, to hold the semaphores in the clear position.

As the train moves to block, 2, both the home and distant signals of 2 will go to danger. The home signal on 3 will go to clear, because the neutral relay will close its contact. The distant signal on 3 will not clear because the circuit breaker, C, will be open when the home signal on 2 starts to go to danger; and, when it has gone to danger, the terminals of 3's track battery will have been reversed, thus holding 3's polarized relay contact open. When the home signal on 3 clears, it will readjust 4's track battery, so that the distant signal on 4 may clear. This system can be readily used for train movement in both directions.

Although the further development of automatic signals aims at the elimination of primary and storage batteries, a practical signal engineer must know how to take care of the batteries which are now installed. The field of signal engineering is just opening, and, in the future, there is no doubt that technically educated men will be more and more in demand. At present it frequently happens that the

technical graduate finds himself handicapped, when starting in signal engineering, because of lack of practical knowledge of the operation of primary and secondary cells. For this reason, a practical study of the operation of the primary cells used in connection with the signals, was an important feature of a thesis on this subject submitted last June.

During the college year of 1906-07, two double semaphore elecceric signals were installed at the college. The signals were furnished by the C., N. O. & T. P. railroad. One of them was manufactured by the Hall Signal Co. and the other by the Union Switch and Signal Co. Both are intended for use with polarized track relays, but, of course, they can be used for any kind of operation.

It is intended to use these signals in thesis work for seniors, and for other experimental work which may be of value to the railroad. Messrs. F. H. Lawson and J. W. Thomas undertook the first thesis work. They found that, while there is considerable literature available which deals with this subject, scarcely any of it is of much value to the student without experience. The most of what has been published until recently was evidently intended for practical signal engineers. Lately there have been some articles in the technical press which should be of great value to the technical student. It may be, though, that the explanations in this article may be of further assistance to some who are interested.

The thesis of Messrs. Thomas and Lawson was in the nature of preliminary experimentation, such as, comparison of efficiencies, obtaining some idea of the power required to operate the signals, and the various battery efficiencies in connection with them. In order that further work might be pursued most intelligently by students in the future, the first thesis was made to contain explanations of practical working circuits.

Since some of the results obtained are somewhat inaccurate, it is hardly fair to use them in comparing the two signals, without allowing for the error. For this reason the two signals will be designated A and B.

In determining the work done in clearing the signals, the motor and mechanism were removed, and the downward thrust of the rod connecting the semaphore with the mechanism was measured. The average thrusts were:

A		B	
Home	Distant	Home	Distant
77.4 lbs.	74.1 lbs.	79.5 lbs	74.38 lbs.

This shows that the tendency to go to danger is the same in both. Each signal rod moves through 4⅛ inches, so that the work done in clearing was:

A		B	
Home	Distant	Home	Distant
In Foot Pounds			
26.6	25.47	27.33	25.57
or in Joules			
36	34.5	37	34.7

The energy furnished to the motors depended upon the voltage of the motor circuits. The results obtained for various voltages are:

A

	Home	Distant
Voltage	Joules	
16	160	167.2
14.3		164
13.5	145.8	
12.1		163.25
11.5	136.85	
10		140.25
9.5	129.2	
7.9	130.25	139
5.9	126	151
4	Clutch released	

B

	Home	Distant
Voltage	Joules	
16	192	192
14.4	196	210
12.2	229	529
10	242.5	221
7.9	272.6	272.6
5.9	260.8	285.6
4	Motor would not operate	

These results show that A is much more efficient than B. But

in looking over the signals some time after the tests had been made, it was found that B's commutator and mechanism was not in such good shape as A's. The brushes were not making good contact, and were cutting the commutator, and parts of the mechanism were not oiled. It was evident, however, that A would have been more efficient than B under the best conditions.

The time required by the signals to clear depended upon the voltage. A took five seconds at 16 volts and sixteen seconds at 6 volts. B took six seconds at 16 volts and twenty-two seconds at 6 volts.

The next test was to determine the voltage at which the clutches would release, allowing the signals to come to danger. To do this, a voltmeter was placed across the terminals of each clutch coil, and, after the signal had been cleared, the voltage was gradually lowered until the clutches released. A released at 4.2 volts, and B at 1.8 volts. This might indicate A's superiority, because of a diminished likelihood of a stray current producing a false clear signal. However, in a 'normal clear' system this advantage is not of much value.

The A signal showed superiority in three points. For the same tendency to come to danger when the clutches were released, it had first, higher efficiency, second, less time in clearing, third, greater tendency for the clutch to release when required.

The remaining time available was devoted to a study of the batteries used in operating the signals, most attention being given to the Gordon cell. This is a type of Edison cell, having a zinc anode, black copper oxide cathode, and electrolyte of caustic soda solution. The electromotive force of several of these cells, measured by a potentiometer averaged .866 volt. The chief difference between this cell and the Edison-Lalande is, that in the latter the oxide is pressed into a solid plate which is held in a frame, while the oxide of the Gordon cell is loose, and contained in a perforated sheet-iron receptacle. The voltage of an Edison-Lalande, measured on the potentiometer was .92 volts, with caustic soda solution for electrolyte. A Gordon cell with caustic potash solution gave .69 volts.

The equation which is supposed to show the chemical reactions is $Zn + Cu O + 2 Na O H + H_2 O = Na_2 Zn O_2 + Cu + 2 H_2 O$.

The molecular weights are as follows:

$Zn + 65$, $Cu O + 79.5$, $Na O H + 40$, $H_2 O + 18$.

Since the zincs weighed about 21 ounces each, the proper weights of the other elements should have been, 25.6 ounces of Cu O, and 25.8 ounces of Na O H. Of course there should be a surplus of H_2 O.

The first test of the batteries was a 'breakdown test' of four Gordon cells. They contained the following weights of elements:

Zn	Cu O	Na O H	H_2 O
21 oz	48 oz	26 oz	80 oz

It will be noted that there is a surplus of Cu O. The condition of the Cu O was varied in each of the four cells. In the first cell it was passed through a ⅛″ square, in the second through a ⅜″ square, in the third the lumps were about ½″ cubes, and in the fourth as large as 1½″x1½″x½″. These cells started with a voltage of .85, as near as it could be read in the voltmeter, after being short-circuited for fifteen minutes the current was about 4 amperes. At the end of eight hours the current had increased slowly to 5 amperes. Then it gradually decreased until, at the end of 76 hours, it reached 1 amp, and the zincs were practically destroyed. The open circuit voltage which was read every hour, dropped to .5 within fifteen minutes and then decreased gradually to .2 at the end of 76 hours. These results are remarkable, and show that the cell is well adapted to close circuit work. When the cells were examined, it was found that about 50 per cent of the oxide has been reduced to copper. The condition of the oxide, from the results obtained does not seem to affect the operation of the cell.

The total energy of a cell can be obtained roughly by multiplying the open circuit voltage reading by the corresponding short circuit current and by the time; and in this case, averaged 80 watt hours or 288000 joules. A battery of sixteen cells, therefore, should have a total energy of 4,600,000 joules. Assuming that each signal operation requires 200 joules, allowing for the energy taken by the clutch coil, the battery should handle 23,000 operations. At fifty operations a day, which would be good for a single track road, the battery should last 460 days. With a signal requiring only 150 joules the battery should last 615 days, or about twenty months.

An operating test was started, in which eighteen cells were connected in the circuit as shown in figure 4.

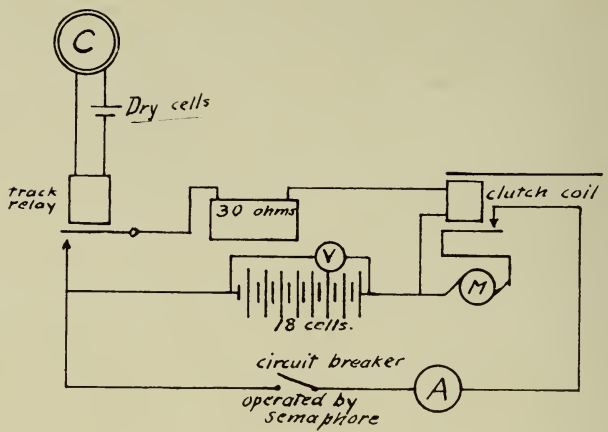


FIG. 4.

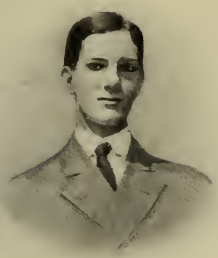
C is a clock arranged so that the hands close the track relay circuit every ten minutes, thus opening the clutch coil circuit, and allowing the signal to come to danger. After two minutes of contact, the track circuit is broken and the signal clears. At intervals the current taken by the motor, the open circuit voltage of the battery and the time of clearing are noted. This test was started May 23, 1907, and up to the present the signal has operated about 18,500 times. One of the glass jars in the battery was broken, and there have been only seventeen cells in the battery for some time. The accidents which have happened from time to time have been almost entirely due to carelessness or ignorance on the parts of the various attendants. In railroad work the chances are that there would be as much carelessness and, possibly less knowledge; so that it is hardly correct to call a system requiring so much attention automatic.

Various other phases of this subject will be investigated from time to time. There is much extremely interesting work yet to be done in signaling, and we hope to soon get beyond the elementary work outlined above and enter into studies which will be richer in experience and of more value to others.

The Latest Development in Street Lighting

By Harry G. Edwards, '05

ARTICLE IV



THE direct current system of arc lighting was the first used for street illumination. Many such systems are still in operation, but in most places they have been superceded by the alternating systems.

It was found that alternating current for lighting purposes gave higher efficiency and better results than direct current, therefore attention of lighting engineers was turned toward the development of alternating arcs. When this lamp attained its highest stage of development, experiments were begun along different lines. As a result the Luminous Arc Lamp was perfected.

The Luminous Arc Lamp is a direct current arc operated on a rectified alternating constant current system.

The alternating current is kept constant by means of a constant current transformer, which also steps up the primary voltage to the required secondary voltage. The secondary coil of the transformer is connected to a series mercury arc rectifier tube which converts the alternating constant current into direct current. Fig. 1 shows the connections of the series mercury arc rectifier set.

The supply current enters the primary or balanced coil. This is counterbalanced by the weight W. Varying this weight is the means by which the current is regulated. As the primary coil approaches the secondary, or stationary coil, the current increases. Therefore to increase or decrease the current in the secondary, weight is either taken off or added as the case might be.

The transformer secondaries are connected through A. C. reactances to the anodes or alternating current terminals of the rectifier tube.

The cathode, or negative terminal, at the bottom of the tube, is connected through a D. C. reactance to the lamps to be operated.

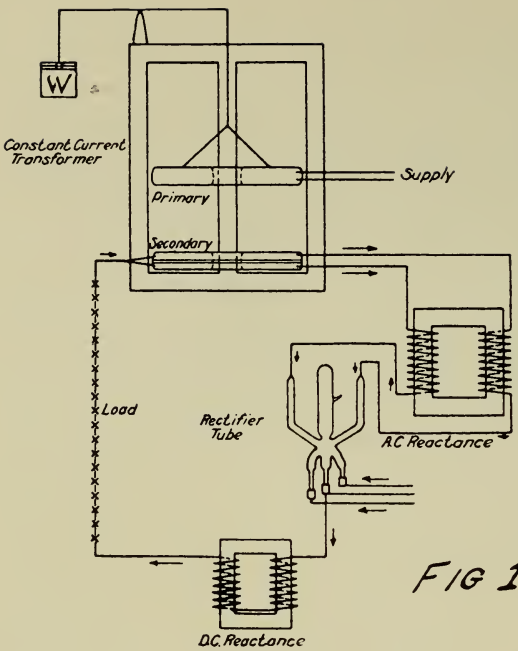


FIG 1

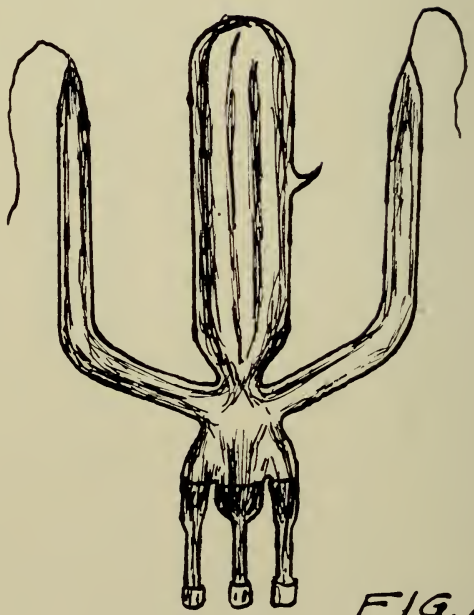


FIG. 2.

SERIES MERCURY VAPOR RECTIFIER TUBE

The return from the lamps is connected to a tap at the middle of the secondary coil of the transformer.

The rectifier tube consists of an exhausted glass vessel, shown below, containing one carbon anode or positive terminal in each of the two upper side arms, two mercury starting anodes and cathode at the bottom of the tube.

The rectifier tube is mounted on the switchboard panel in a movable wooden holder. By shaking this holder slightly the mercury is caused to flow from the mercury starting anodes to the mercury cathode. These starting terminals are connected to a low voltage starting circuit. When the mercury flows between terminals it closes the starting circuit causing a small arc. This arc is the vaporized mercury which forms the path for the main current. When the primary current is thrown on the constant current transformer, the secondary current finds a ready path through the rectifier tube, and once its arc is formed the current will operate until the primary circuit is opened.

The process of the alternating current being rectified into direct is very simple. Each time the current in the secondary coil changes direction it also changes the anode on the rectifier tube. The current flows from one anode to the cathode through the first half cycle, and from the other anode to the cathode through the other half cycle. Therefore the current in the cathode has but one direction and is consequently direct. As previously stated, the current from the cathode passes through the lamps back to the middle tap of the secondary coil of the transformer.

At first thought it would seem as if the current supplied to the line is pulsating. This is taken care of by the A. C. reactances between the secondaries of the transformer and rectifier tube. When the current in one arm of the tube is approaching its zero value the reactance gives it a lag so that before it falls below a certain value, the current in the other arm strikes its arc. In this manner a direct current with a slight wave form is obtained.

In conclusion I will name some of the advantages the luminous arc lamp has over all other lamps in commercial use to-day.

The spectrum of the luminous arc is practically the same as that of the sunlight. The electrodes are entirely different from the carbon electrodes used in other arc lamps. The upper electrode, or

positive, consists of a bar of hard drawn copper supported by iron wings. The lower electrode is made of a magnetite composition, contained in an iron tube 5/8″ diameter by 8″ long.

The copper electrode has a life of 4,500 hours, and the magnetite electrode of from 175 to 200 hours.

The efficiency of the luminous arc light is much higher than that of any other arc light. It consumes 310 watts and gives the same intensity of illumination at 309 feet, that a 480 watt alternating current inclosed series lamp gives at 247 feet.

In summing up the many advantages of the luminous arc lamp over all others, namely, its efficiency, distribution of light, color of light, and low maintenance cost, it is small wonder that this lamp should mark a new epoch in street lighting.

The Steam Engine Indicator

By V. E. Muncy, '08

ARTICLE V

The generation of power is so intimately associated with all the industrial enterprises of to-day, and power is so generally developed by the steam engine, hence the indicator is a necessary part of the equipment of the modern power plant.

When carefuly manipulated the indicator gives results which may be trusted implicitly. The admission line, the steam line, the expansion line, the line of release, the back pressure line and the line of compression are so definite in the information which they give that the engineer may know precisely what occurs in the cylinder during each instant of the stroke. Irregularities in the card tell him exactly what modification should be made in order to correct the fault or faults. He may then set the valve so as to cause the engine to give maximum power output for minimum intake in heat units.

The use of the indicator enables the engineer to know, at any time, the power the engine is exerting, and by this means to detect causes outside of the engine room through which energy is wasted.

Shafts out of alignment and defective machines leave their mark on the indicator diagram and thereby call attention to these needless sources of waste in fuel.

In the absence of dynamometers of special design and adaptation, the indicator may be used and is being used more and more as its possibilities are better understood for the determination of the horse power necessary to operate special machines. For instance, a blower may be thrown open, say to a cupola, while all the other belts driven by the engine are running on idle pulleys.

A card is then taken by the indicator in the usual manner. The blower is then taken off, and another card is taken, and, of course, the difference is the actual horse power necessary to drive the blower.

The Mechanical Engineering and Electrical Engineering Record

EDITORIAL SECTION.

Published by the Department of Mechanical and Electrical Engineering of the State College of Kentucky and devoted to the interests of the students and alumni and to the welfare of the department and of the college.

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THE PURPOSE OF THE MECHANICAL ENGINEERING AND ELECTRICAL ENGINEERING RECORD.

For a number of years there has been a decided need for a magazine that would put in permanent shape some of the scientific work that has been done by the students and graduates of the department of mechanical and electrical engineering of the State College of Kentucky. Those in charge of this department have hesitated to begin the publication of a magazine on a somewhat pretentious scale, until the present time. So much financial encouragement has

been given this project, that beginning with this issue, there will be published each month, from the State College, a technical journal that will be made equal to any periodical from a scientific school.

The purposes of the magazine are as follows:

First, to record contributions to engineering science in the shape of recent original scientific investigations, made by instructors, students and alumni of the State College of Kentucky.

Second, to record the various elements in the material growth of the State College.

Third, to present short biographies of men closely related to engineering progress, or who are identified indirectly with the training of engineers at the State College of Kentucky.

The publication will be under the supervision of the School of Mechanical and Electrical Engineering; although the actual responsibility will rest with the Board of Student Editors appointed by the department.

A large number of graduates from the State College have gone into the field of mechanical engineering and electrical engineering, and have been successful in carrying to a conclusion many important engineering problems in the centers of industrial activity in the east and north. Many contributions have been secured from State College graduates, and the magazine each month, will contain a number of interesting discussions on live engineering topics. The important events in State College history will be presented each month, and whereas this publication does not expect to cover exhaustively every phase of local college life, the more striking features will be given space. Illustrations will be used liberally throughout the magazine, and all of the pictures presented will be new.

It is the aim of the promotors of the Mechanical Engineering and Electrical Engineering Record, to make a magazine that will be an artistic and reliable medium for the presentation of important facts pertaining to our State College life in general, together with the scientific work done by students and alumni of the department of mechanical and electrical engineering.

⌘ ⌘ ⌘

Among the contributions to the first edition of the "Record" will be noticed "The Purchase of Coal under a Specification," by Mr. Philip M. Riefkin, and "A New Development in Street Lighting," by Mr. Harry G. Edwards.

Mr. Riefkin is a member of the class of '06, B. M. E., and is now employed in the Technological Branch of the United States Geological Survey, with offices in Washington, D. C.

Mr. Edwards was graduated with the class of '05, and was for some time with the Schenectady Works of the General Electric Co. Within the past year he has been transferred to the Cincinnati office of the same company and is now prominently connected with the erecting department.

¤ ¤ ¤

Among the recent visitors at the College have been the following graduates, who will be remembered by their old classmates:

Mr. Thos. Warnock, '02, now with the Chicago and Northwestern Railway Co.; Mr. R. E. Dragoo, '06, with the Atlas Engine Co., of Indianapolis; Mr. S. M. Morris, '05, with the Anaconda Copper Mining Co., Anaconda, Montana; Mr. W. H. Grady, '05, with the Atlas Engine Co., of Indianapolis.

¤ ¤ ¤

We were recently honored by a visit from Dr. Jo. H. Kastle, formerly Professor of Chemistry at this institution, but now engaged in Chemical work for the United States Government in Washington, D. C., as Chief Chemist, Hygienic Laboratory, Marine Hospital Service.

Dr. Kastle spent several days at the College, and while here made a short talk to the Mechanical Engineering Seniors, which was thoroughly appreciated by all.

Mechanical Hall, State College of Kentucky in 1907

ARTICLE VI

Within the last twelve months a number of additions have been made to the equipment of the department of mechanical anl electrical engineering, and several new recitation rooms and offices have been provided. About a year ago, substantial additions were built on the south and north ends of Mechanical Hall. The accompanying views give a good representation of the various rooms in Mechanical Hall at the present time.

LOOKING ACROSS THE FRONT OF MECHANICAL HALL

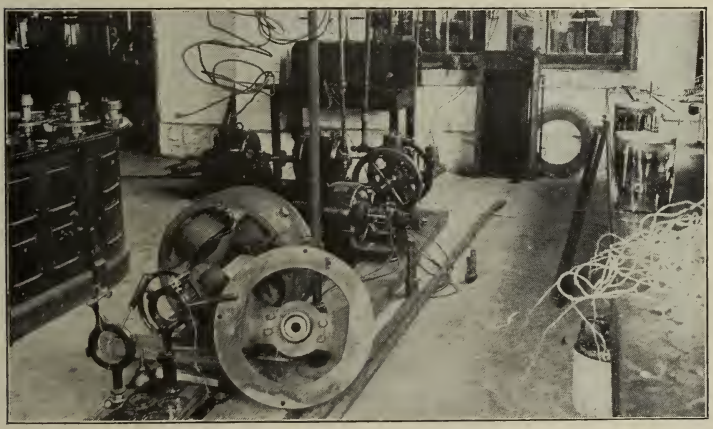
A CORNER IN THE SENIOR READING ROOM

OFFICE OF THE DIRECTOR

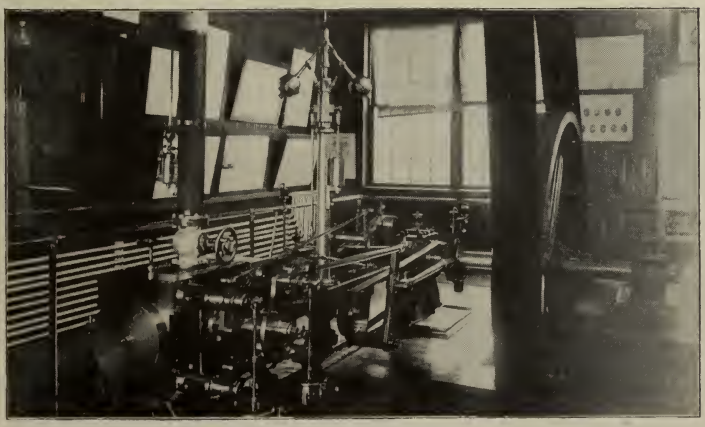
STEAM ENGINEERING LECTURE ROOM

JUNIOR DRAWING ROOM

OFFICE OF PROFESSOR OF ELECTRICAL ENGINEERING



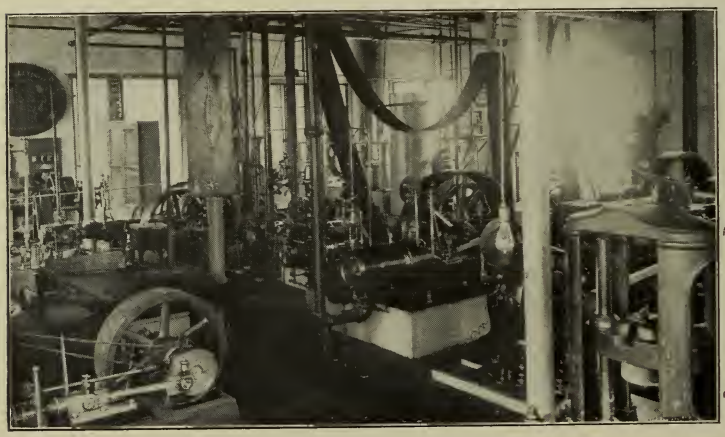
ELECTRICAL LABORATORY



CORLISS ENGINE DRIVING SHOPS

MACHINE DESIGN RECITATION ROOM

SWITCHBOARD, ELECTRICAL LABORATORY



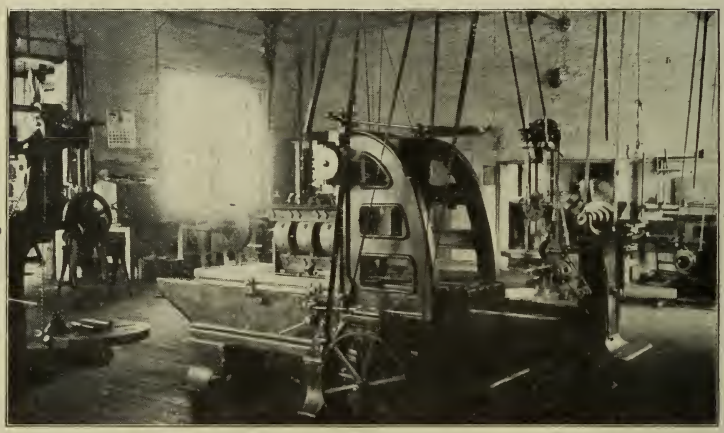
STEAM AND ELECTRICAL LABORATORY

ELECTRICAL ENGINEERING LECTURE ROOM

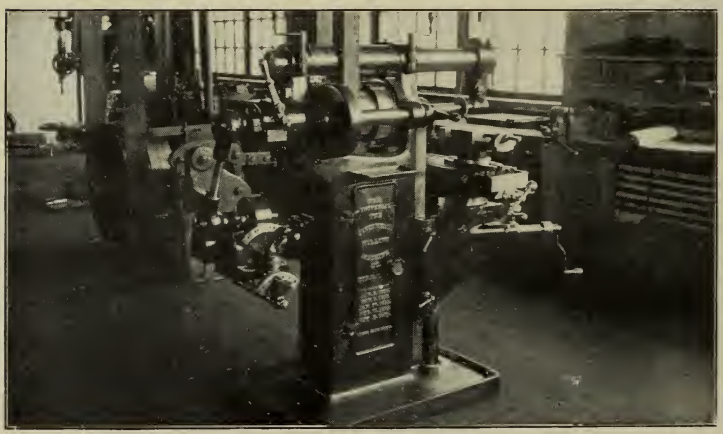
A CORNER IN THE FOUNDRY

MACHINE SHOP ANNEX

A CORNER IN THE FORGE SHOP

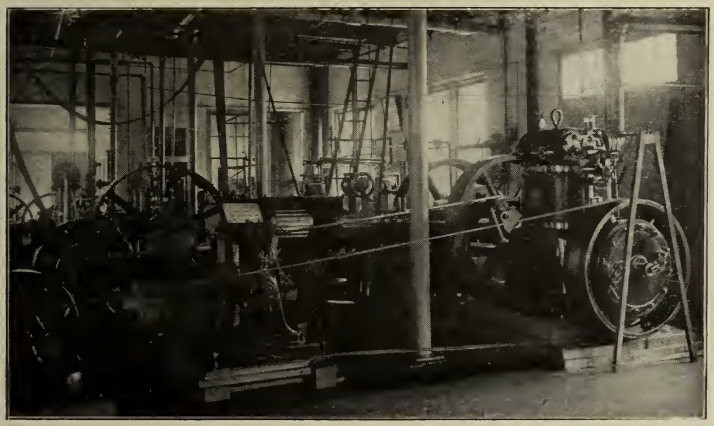


MACHINE SHOP



A CORNER IN THE MACHINE SHOP

A CORNER IN THE WOOD SHOP



STEAM AND ELECTRICAL LABORATORY

MECHANICAL HALL, STATE COLLEGE OF KENTUCKY IN THE YEAR NINETEEN HUNDRED AND SEVEN

Our New Buildings

ARTICLE VII

LIBRARY.

The new library, although one of the smallest buildings on the campus, will be one of the most attractive. Our College is growing rapidly and is coming to be a little city within itself and with all it is becoming in a true sense, a "city beautiful."

The library will be 56 feet square. There will be but one single story above the basement. This, however, will be of the same height as would ordinarily be given to a two story building. Inside, there will be a wide balcony, at the proper height of a second floor, running entirely around the large central reading room.

The basement is well lighted and is so high that it will be used for a reading room and for ranges of book cases. The basement is built of very heavy rough stone, 20″ thick, each block being cut to the same size. The upper walls are built of pressed brick. The front of the building will be especially attractive. It is arranged in the form of an artistic facade, of which the elaborate windows will be a conspicuous part. Artistic lamp posts will be on each side of the en-

trance. The approach to the entrance will be a beautiful stone staircase, the feature of which will be its simplicity of outline and massiveness of structure. It is hoped the new building can be occupied shortly after the Christmas holidays.

NORMAL BUILDING.

Realizing the need of better instruction in the common schools, the General Assembly established the Normal Department in 1880. Ten years ago a four year's collegiate course with Padagogy as a major study was established. From the first the department has done a great work in preparing efficient teachers for the schools of the state. Each county in the state is entitled to four appointees to the school each year. The influence of these carefully prepared teachers is doing a great deal for the betterment of education throughout the state.

The Normal Department formerly occupied a part of the Main Building; but its rapid growth in recent years, under the able management of Professor Milford White, made a new building a necessity. The new home of the school was designed particularly for its use, and represents the most approved style of modern school architecture. The equipment throughout is all that can be wished. All the helps to up-to-date school-work are provided. The building

contains ten large class-rooms, a well appointed study-room for young women also one for young men, a library-room for the department and two offices. On the third floor there is the largest and best equipped literary society room in the state, for the use of the Normal Literary Society. Provision is also made for a Model School—an important adjunct to the regular work of the school.

AGRICULTURAL HALL.

In spite of the fact that this an "Agricultural and Mechanical College," the Department of Agriculture has never had a building of its own.

While the character of work, under the supervision of the Dean, Professor Matthews, has always been effective, notwithstanding the inconveniences, yet the increasing scope of the department demanded increased space.

Accordingly, at a recent meeting of the Board of Trustees, a measure was passed providing for the erection of one wing of a building to be devoted entirely to agricultural work.

The accompanying cut is from a photograph of the wing now under construction.

Work on this building is being pushed and it will soon be ready for occupancy.

It is to be three stories high besides the basement, 45 x 100 feet in size, and built of pressed brick and Bedford stone.

The basement is to contain large rooms arranged for farm machinery, general farm mechanics, potting and propagating, and for the heating plant.

On the first floor will be the office of the Dean of the department, the general and advanced plant laboratories, the horticultural lecture room and horticultural laboratory; on the second floor the offices of the division of animal husbandry, and an attractive reading room and society hall.

The third floor will provide space for an agricultural museum, a commodious hall for the State Grange and other agricultural society meetings and exhibitions, and a photographic laboratory.

The cost of the wing will be about $30,000.

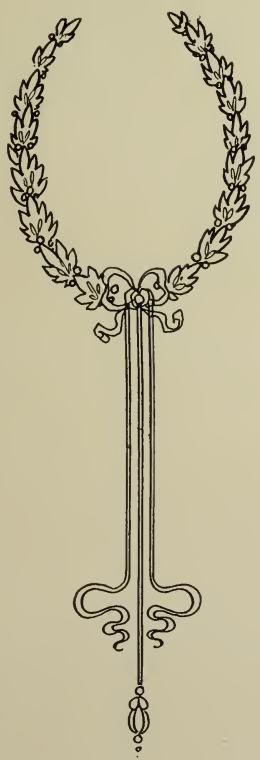
Within a few years the main body of the building and other wing will be added, and when completed, the structure will be one of the most imposing on the campus.

MINING LABORATORY.

The new Mining Laboratory of the School of Mines of Kentucky State College, is now in course of construction, and is expected to be completed, ready for use, not later than January 1. It is 80 x 40 feet in the clear and two stories in height, solidly constructed

of brick and stone; red pressed brick being used outside, while the inside walls are of grey brick. The roof is of slate and first floor of concrete. The building is to be lighted both by gas and by electricity, and to be heated by gas.

The first floor will be used as a mining laboratory proper and will contain the various kinds of mining machinery used in the course; also exhibits of the State Museum, which are too large to put in the museum on the top floor of the Science Hall. The second story will contain the assaying and metallurgical laboratories. This will enable the apparatus for assaying to be moved from its present close quarters in the Chemistry building to very commodious ones in the new laboratory. This will be of great service to the mining course, and its completion is looked forward to with interest by the students of that department.



ATHLETICS

ARTICLE VIII

In the heart of any man, student or alumnus, who has ever had the love for his college that he should have, there is a spot reserved for athletics, and particularly for foot-ball.

It would be hard to find one on the roll of alumni, who would not give a good part of his month's salary to be able to see State win the Thanksgiving game.

With hardly an exception the great colleges and universities of the country are giving their support to athletics, realizing its value as a promoter of "college spirit"—the life of any institution.

State's reputation as a supporter of pure, clean athletics grows better every day.

As coach of the foot-ball team we have Mr. White Guyn, who accomplished such good results with the team last year.

Of the old players, those who returned this year, are: Adair, Captain; Stone, Chisholm, Elgin, Hendrickson and Dunlap, while there is plenty of new material to fill all vacancies and to make a wonderfully strong team.

Rodes, Rout, Payne, Barbee and Clark are practically certain of their places on the team.

The opening game of the season was to have been played with Kentucky Wesleyan College, but a few days before the date set, was cancelled. By some strenuous hustling, Manager Bryant secured a game with Louisville Manual Training School.

While the Manual boys put up a fast and snappy game, they could make no gain against such a superior weight.

Stone, State's quarter-back, made several good runs around the ends, while Chisholm, playing left half, made a forty-yard run on a delayed pass.

The final score was 30 to 0.

On the 5th of October, the team went south to play Vanderbilt, the result being 35 to 0 in favor of Vanderbilt.

In the face of such a score, it is nevertheless true that the Kentucky team put up a splendid game, nearly every one of Vanderbilt's scores being made on a forward pass or trick play.

THE '07 FOOT-BALL SQUAD

On line plunges the State boys held their own throughout the game.

The double forward pass and delayed pass were used extensively by the Tennessee team, and when successful, generally resulted in a touchdown.

In the second half, State succeeded in blocking nearly all the trick plays and kept the score nearly the same as at the close of the first half.

The defeat at Vanderbilt resulted in increased activity in practice, and on October 12th the team showed what they really could do.

On this date they were matched on the home grounds against Morris Harvey College of West Va., whose team was of exactly the same weight as our own.

From the first kick-off it was evident that State would be victorious.

With the improvement in handling plays and the increase in speed that had been made by the squad since the previous game, several excellent plays were made, one of which was a touchdown made by Stone from a kick-off.

The forward pass was used frequently with success.

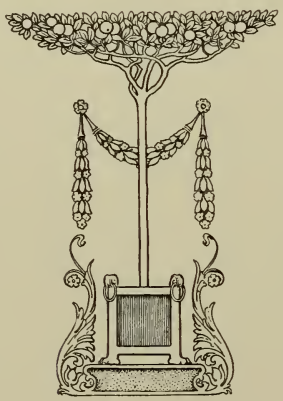
The game closed with the score State 28, Morris Harvey 0.

H H H

A meeting of the Athletic Association was held recently for the election of officers for the ensuing year.

The following were those elected: President of the Association, W. O. Alden; Vice-President, J. S. Croswaithe; Secretary, T. R. Bryant; Manager of the Basket Ball Team, William Rodes; Manager of Track Team, M. S. Smith; Asst. Manager of Base Ball Team, E. B. Perrine; Asst. Manager of Foot Ball Team, B. E. W. Stout.

Under the rules of the Association, the Assistant Managers become the Managers for the next year, thus giving them a chance to familiarize themselves with the work before they become real Managers.



The Freshman-Sophomore Flag Rush

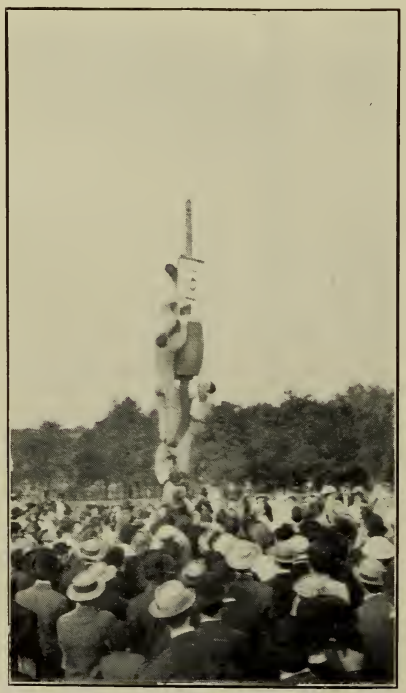
ARTICLE IX

THE FRESHMAN-SOPHOMORE FLAG RUSH.

The Freshman-Sophomore flag-rush will be one of the main attractions in college life during the first month of school from now on. The upper classmen of last year, thinking the opening weeks of school entirely too tame, hit upon the ingenious plan of having the Freshman and Sophomores furnish a highly-diverting act in real life in the form of a spectacular "knock-down-and-drag-out" fight. They set about arousing the necessary class spirit for such an affair. They began this by painting large '10s in the Freshmen colors all over the campus. It was then an easy matter to persuade the "Sophs" that the "Freshies" were trying to run things and needed

to be "taken down a notch or two." The result far exceeded the most sanguine expectations of the upper-classmen. The Freshmen put their flag at the top of a greased telegraph pole and kept it there for about two hours. Finally a Sophomore got the coveted emblem by crawling on wires from another pole. And when the flag fight was over, every one knew that the Freshmen-Sophomore flag-rush would be an annual event.

By the terms of agreement this year, the flag was not to be more than fifteen feet high, and the pole was not to be greased. Both sides chose leaders and carefully planned means of offense and defense. The Freshmen put a large barrel around the flag-pole just under the flag, which was enclosed in a strong frame. The Sophomores formed in three attacking parties, led by Hendrickson, Montgomery and Clark. The Freshmen, under the leadership of Collins and Short, were closely packed around the pole. The three attacking parties charged fiercely. Some of the "Sophs" tried to climb over their adversaries and reach the pole; but all such attempts were in vain.



Now came a series of desperate hand-to-hand struggles. No one was hurt seriously; but several were temporarily laid out. Clothes were soon at a premium. A shirt with a front and one sleeve was in a good state of repair. The girls of the two classes were everywhere, giving water to their worn-out heroes. The yells of the girls were particularly effective during the fight, and cheered both sides to their utmost. The girls seemed more concerned about the outcome than the boys; indeed, quite a lively "scrap" burst out among the girls themselves.

All attempts at mounting the pole having proved futile, the Sophomores withdrew to the Gymnasium for a council of war. They soon reappeared on the scene in bands of six or eight. Each squad seized a Freshman and carried him kicking and struggling to the Armory, where he was tied and guarded. The Freshmen could not leave the pole to help their comrades, so that in a short time most of them were in the Armory. However, they sent a man up the pole to protect the flag from anyone who might attempt to climb it. Nevertheless, the Sophomores finally succeeded in getting a part of the flag, and would have gotten all of it by cutting the pole, had not some of the faculty interposed. At this juncture there was a grand jail delivery of the imprisoned Freshmen, who came bounding out drew, however, claiming the victory. Public opinion, however, gave the laurels to the Freshmen.

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